

REMARKS

Claims 1-20 are pending in this application. By this Amendment, claims 1, 3, 5, 6, 8 and 10 are amended and claims 11-20 are added. Support for new claims 11-20 can be found in the original specification, for example, see pages 4-7. Reconsideration in view of the above amendments and following remarks is respectfully requested.

1. 35 U.S.C. §112

The Office Action rejects claims 1-10 under 35 U.S.C. §112 as being indefinite. Applicants submit that the above amendments to claims 1, 3, 5, 6, 8 and 10 obviate the rejection of claims 1, 3, 5, 6, 8 and 10. As to the rejection of claims 4 and 9, Applicants submit that claims 1 and 6 recite "a cation exchange group-containing polymer" therefore, "the cation exchange group in the polymer" of claims 4 and 9 does not lack antecedent basis, as the polymer of claims 1 and 6 could have been recited as "a polymer containing a cation exchange group."

Concerning claims 1 and 6, Applicants submit that it is clearly set forth that Applicants are currently claiming both formula 1 and 2 as specifically stated in claims 1 and 6, wherein "a modified silica in which silicon atoms have substituents as represented by formula 1 and formula 2" (emphasis added).

Withdrawal of the rejection is respectfully requested.

2. 35 U.S.C. §103(a)

The Office Action rejects claims 1-10 under 35 U.S.C. §103(a) as being unpatentable over *Nakano et al* (U.S. Patent Publication No. 2002/0061432,

hereinafter referred to as "*Nakano*") in view of *Deng et al's* publication ("Novel Nafion/ORMOSIL Hybrids via in-situ Sol-Gel Reactions: 2. Probe of ORMOSIL Phase Nanostructure by Si Solid State NMR Spectroscopy," hereinafter referred to as "*Deng*").

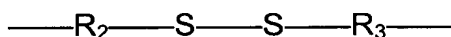
As stated on page 5 of the Office Action, "Nakano et al does not expressly disclose the silicon-based material having the specific silicon-hydrogen bond, and the specific weight content and grain size." See page 5 of the Office Action. However, the Office Action further states that "Deng et al disclose a NAFION-organically modified silicon (ABSTRACT) wherein all membranes are converted to the SO₃H form (P. 179, Left Column, 3rd full paragraph)." See page 5 of the Office Action.

Claim 1 recites a composite electrolyte membrane comprising a modified silica in which silicon atoms have substituents as represented by formula 1 and formula 2; and a cation exchange group-containing polymer:

Formula 1



Formula 2



wherein, R₁ is an alkylene group with 2-7 carbon atoms, X is a hydrogen atom or an alkali metal, R₂ and R₃ are each independently an alkylene group with 2-7 carbon atoms.

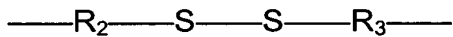
Claim 6 recites a fuel cell comprising a cathode; an anode; and an electrolyte membrane being placed between the cathode and the anode, the electrolyte

membrane being a composite electrolyte membrane comprising a modified silica in which silicon atoms have substituents as represented by formula 1 and formula 2; and a cation exchange group-containing polymer:

Formula 1



Formula 2



wherein, R₁ is an alkylene group with 2-7 carbon atoms, X is a hydrogen atom or an alkali metal, R₂ and R₃ are each independently an alkylene group with 2-7 carbon atoms.

Deng fails to cure the deficiencies of *Nakano*. On page 179, left column, third full paragraph, which was indicated in the Office Action as disclosing NAFION-organically modified silicon, *Deng* is disclosing organically modified silicates (ORMOSIL) which are produced by including organoalkoxides, R'_nSi(OR)_{4-n}, in solutions containing Si(OR)₄. See page 177 of *Deng*. However, *Deng* clearly does not disclose or suggest, the combination of features recited in claims 1 and 6, including at least the feature of a modified silica in which silicon atoms have substituents as represented by formula 1 and formula 2, wherein formula 1 includes $\text{---R}_1\text{---SO}_3\text{X}$ and formula 2 includes $\text{---R}_2\text{---S---S---R}_3\text{---}$. Rather, neither *Deng* nor *Nakano* disclose or suggest silicon atoms having the claimed substituents.

Applicants note that the composite electrolyte membrane of claims 1 and 6 include both a cation exchange group-containing polymer and a modified silica in

which silicon atoms have substituents as represented by formulas 1 and 2, and that the cited references fail to disclose or suggest modified silicon atoms as claimed.

For at least the reasons set forth above, Applicants respectfully submit that claims 1 and 6 are allowable. Claims 2-5 depend from claim 1 and claims 7-10 depend from claim 6, and are allowable for at least the same reasons. Withdrawal of the rejection is respectfully requested.

3. New Claims

New claims 11-20 have been added to the application. Claims 11 and 12 depend from claims 1 and 6, respectively and are allowable for at least the same reasons that claims 1 and 6, respectively are allowable. Claim 13 recites a modified silica comprising silicon atoms bonded with a propane sulfonates group and a disulfide group, and the cited references fail to disclose or suggest at least this feature, as well as the combination of features of claim 13. Thus, Applicants respectfully submit that claim 13 is allowable. Claims 14-19 depend from claim 13, and are allowable for at least the same reasons that claim 13 is allowable. Claim 20 recites a method of preparing a composite electrolyte membrane, wherein the combination of features is not disclosed or suggested by the cited references.

For at least the reasons mentioned above, Applicants respectfully submit that all pending claims are in condition for allowance.

4. Conclusion

Applicants note that independent claims 1 and 6 have been amended merely to correct an informality and that such amendments were not intended to alter the scope of the claimed invention.

Applicants invite the Examiner to contact Applicants' representative at the telephone number listed below if any issues remain in this matter, or if a discussion regarding any portion of the application is desired by the Examiner.

In the event that this paper is not timely filed within the currently set shortened statutory period, Applicants respectfully petition for an appropriate extension of time. The fees for such extension of time may be charged to our Deposit Account No. 02-4800.

In the event that any additional fees are due with this paper, please charge our Deposit Account No. 02-4800.

Respectfully submitted,

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